Marian University

Leighton School of Nursing

Doctor of Nursing Practice

Final Project Report for Students Graduating in May 2023

A Retrospective Study on the Use of Intraoperative Subhypnotic Propofol Infusion in Conjunction with Volatile Anesthetics to Decrease PONV

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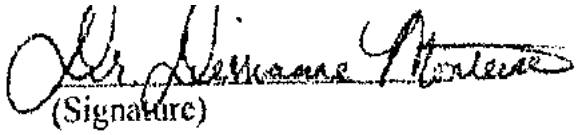

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Table of Contents

Abstract

Background and Review of Literature: Postoperative nausea and vomiting (PONV) frequently occur in patients after anesthesia, significantly impacting patient satisfaction and potentially leading to untoward complications. Multimodal PONV prophylaxis for patients with increased risk factors should be implemented to decrease stay in the PACU and healthcare cost. While research has been extensively conducted on the use of multimodal prophylaxis using antiemetics, such as ondansetron and dexamethasone, research on combining those therapies with a subhypnotic propofol infusion during anesthesia with a volatile anesthetic has been insufficient.

Purpose: This DNP project was designed to determine whether the addition of a continuous subhypnotic propofol infusion in conjunction with a volatile anesthetic decreases the incidence of PONV.

Methods: This project utilizes a quality improvement design by the evaluation of a practice intervention to improve the guidelines on preventing PONV after anesthesia. A retrospective chart review was conducted, and Microsoft Excel was used to perform all statistical analyses.

Implementation Plan/Procedure: A total of 60 patient EMRs met the criteria for this project and were utilized in this study. The patient EMRs were separated into a control and experimental group. Those in the experimental group all received a subhypnotic propofol infusion at 0.1-0.5 mg/kg/hr. The incidence of PONV in the PACU was recorded and compared for both groups.

Implications/Conclusion: The results of this study concluded that the addition of a continuous subhypnotic propofol infusion in conjunction with a volatile anesthetic presents no added benefit in decreasing the incidence of PONV in the PACU.

Keywords: Subhypnotic Propofol Infusion, Volatile Anesthetic, PONV

A Retrospective Study on the Use of Intraoperative Subhypnotic Propofol Infusion in Conjunction with Volatile Anesthetics to Decrease PONV

This project is submitted to the faculty of Marian University Leighton School of Nursing as partial fulfillment of degree requirements for the Doctor of Nursing Practice, Certified Registered Nurse Anesthetist track. Postoperative nausea and vomiting (PONV) frequently occur in patients after anesthesia, significantly impacting patient satisfaction and potentially leading to untoward complications, including delayed recovery, prolonged hospitalization, and increased healthcare costs. The incidence of PONV affects approximately 30% of patients undergoing general anesthesia and drastically increases to 80% for those with multiple risk factors (Jokinen et al., 2012). The Apfel simplified risk score is one of the most widely known scoring systems to predict the incidence of PONV, comprising of four risk factors: “female gender, nonsmoking, history of motion sickness or PONV, and the use of postoperative opioids” (Apfel et al., 1999). Due to the multifactorial nature of PONV, other risk factors that contribute to the increased incidence include age less than 50, type of surgery, such as cholecystectomy, gynecological, and laparoscopic surgeries, duration of surgery, general anesthesia, nitrous oxide, volatile anesthetics, and etomidate (Shaikh et al., 2016).

The American Association of Nurse Anesthesiology (AANA) has published several articles demonstrating effective prophylactic regimes on the prevention of PONV, but there remains to be high variability with the proposed interventions, thus making PONV an unrelenting issue in the anesthesia community (AANA, 2021). Propofol, a widely used induction and maintenance medication during anesthesia, has several advantages, such as producing a dose-dependent decreased level of consciousness, rapid onset of action, predictable duration, and an antiemetic effect (Folino et al., 2021). Volatile anesthetics (isoflurane, desflurane, and

sevoflurane) are commonly used for induction and maintenance of general anesthesia due to their advantageous profile of providing amnesia, immobility, and exerting cardioprotective effects with the most common disadvantage of causing PONV (Miller et al., 2021). The antiemetic properties of propofol allow it to be utilized in total intravenous anesthesia (TIVA) in patients at high-risk for PONV, but the effects of a subhypnotic dose of propofol as a continuous infusion in conjunction with a volatile anesthetic has not been extensively researched.

Background

The increased incidence of PONV in patients after anesthesia has led to extensive research on the efficacy of numerous antiemetics and alternative approaches and techniques to improve the quality of patient care. PONV is a complex problem with a multifactorial etiology. The stimulation of the vomiting reflex involves five afferent pathways, including "the chemoreceptor trigger zone (CTZ), the vagal mucosal pathway in the gastrointestinal system, neuronal pathways from vestibular system, reflex afferent pathways from the cerebral cortex, and midbrain afferents" (Shaikh et al., 2016). Stimulating any one of these afferent pathways sends inputs to the vomiting center located in the reticular formation in the brainstem controlling nausea and vomiting (Shaikh et al., 2016). While guidelines on the prevention of PONV exist, there are limitations to their efficacy due to the focus on specific patient populations, not addressing all aspects of management of PONV, or not providing results based on current literature (Gan et al., 2020).

The fourth consensus guidelines for the management of postoperative nausea and vomiting based on published clinical evidence and reviewed by an international multidisciplinary expert panel provide strategies to reduce the risk for PONV, which include "minimizing perioperative opioids, use of regional anesthesia, use of propofol infusions as the primary anesthetic, avoidance of volatile anesthetics, and adequate hydration" (Gan et al., 2020). Multimodal PONV prophylaxis

for patients with increased risk factors should be implemented by every provider to decrease stay in the PACU, healthcare cost, dissatisfaction, and readmission. The fourth consensus guidelines recommended the use of multimodal prophylaxis in patients that present with PONV risk factors. Patients at an increased risk for PONV that have 1-2 risk factors should receive two prophylactic therapies, while those with greater than two risk factors should receive 3-4 prophylactic therapies (Gan et al., 2020). The prophylactic therapies include 5-HT3 receptor antagonists, corticosteroids, antihistamines, dopamine antagonists, propofol anesthesia, NK-1 receptor antagonists, acupuncture, and anticholinergics with an anti-emetic from a different class than the chosen prophylactic drug for rescue treatment (Gan et al., 2020). A common combination therapy for PONV includes a 5-HT3 receptor antagonist and dexamethasone. Ondansetron, the "gold standard" in management of PONV, is the most common 5-HT3 receptor antagonist utilized with similar antivomiting and antinausea effects (Gan et al., 2020). Dexamethasone, a glucocorticoid, not only improves PONV, but has also been shown to reduce the need for analgesics if given at the time of induction (Gan et al., 2020).

While research has been extensively conducted on the use of multimodal prophylaxis using antiemetics, such as ondansetron and dexamethasone, research on combining those therapies with a subhypnotic propofol infusion during anesthesia with a volatile anesthetic has been insufficient. Vari et al. (2010) conducted a randomized study on the incidence of PONV in patients receiving propofol versus sevoflurane for anesthesia maintenance after thyroidectomy. Female patients who received sevoflurane during maintenance had a 70.6% incidence of PONV, while those who received propofol had a 42.4% incidence, concluding that the incidence of PONV was significantly higher in female patients that received sevoflurane (Vari et al., 2010). Vari et al. (2010) disclosed that maintenance of subhypnotic propofol by continuous infusion

may be effective in decreasing the incidence of PONV, but the lack of research in the topic is evident. Schraag et al. (2018) conducted a meta-analysis that revealed a reduction in PONV when utilizing propofol-based TIVA over volatile anesthetics with a 39% risk reduction thus improving patient satisfaction. Multiple studies have been conducted on the use of TIVA in preventing PONV, but research lacks in the efficacy of utilizing a subhypnotic propofol infusion with a volatile anesthetic to decrease PONV.

Multiple studies have been published on the incidence of PONV with patients who received a volatile anesthetic during anesthesia compared with patients who received propofol-based TIVA, yet few studies exist that focus on the incidence of PONV with patients who received a volatile anesthetic combined with a continuous subhypnotic propofol infusion. The advantages of using volatile anesthetics may outweigh their disadvantage of causing PONV, especially when combined with a continuous subhypnotic propofol infusion.

Problem Statement

Patients continue to report PONV as one of the most unpleasant side effects of anesthesia, delaying discharge from the PACU by nearly 20 minutes with every episode of emesis (Gan et al., 2020). The significance of this study focuses on surgical patients undergoing general anesthesia with a volatile anesthetic and utilizing a subhypnotic propofol infusion during the length of the procedure to decrease the incidence of PONV. Along with other antiemetic medications for PONV prophylaxis in high-risk patients, this study's aim is to reveal whether the addition of a subhypnotic propofol infusion further decreases PONV in the PACU. A retrospective study was conducted utilizing patient's electronic medical records from a hospital to determine the incidence of PONV in patients who received a volatile anesthetic and a continuous subhypnotic propofol infusion compared with patients who only received a volatile anesthetic. The results of this study provide

evidence to whether the addition of a continuous subhypnotic propofol infusion during anesthesia with a volatile anesthetic decreases the incidence of PONV.

Gap Analysis

Best practice highly recommends the use of multimodal prophylaxis in patients with one or more risk factors by using a combination therapy of antiemetics with different drug classes, such as a 5-HT3 receptor antagonist with dexamethasone, which is implemented as the current practice at the project site (Gan et al., 2020). Best practice includes approaches, such as the use of propofol infusions as the primary anesthetic and the avoidance of volatile anesthetics, to decrease baseline risk for PONV (Gan et al., 2020). Current practice at the project site differs from best practice due to the decreased incidence of using propofol infusions as the primary anesthetic and increased incidence of using volatile anesthetics. The increased incidence of using volatile anesthetics places patients at an increased risk for PONV. Current practice at the project site combines the use of a volatile anesthetic with a continuous subhypnotic propofol infusion during general anesthesia.

Review of Literature

The focus of this literature review is to present current evidence regarding the benefit of utilizing a subhypnotic propofol infusion in conjunction with a volatile anesthetic to decrease the incidence of PONV. The databases searched for literature were PubMed and the Cochrane Library. The search was conducted from November 2021 to January 2022. The keywords utilized were *postoperative nausea and vomiting, propofol, subhypnotic propofol infusion, volatile anesthetics, inhalation,* and *anesthesia.* BOOLEAN phrases were used to combine keywords such as postoperative nausea and vomiting AND propofol AND inhalation anesthesia, and postoperative nausea and vomiting AND propofol infusion AND volatile anesthetics.

Seventy articles resulted from the search, however 59 of those articles were eliminated after applying the inclusion and exclusion criteria. The inclusion criteria included systematic reviews, meta-analyses, and randomized controlled trials written between 2017-2021, including patients that received a volatile anesthetic combined with a propofol infusion who were assessed for postoperative nausea and vomiting. Exclusion criteria included patients that did not receive a volatile anesthetic combined with a propofol infusion and those who were not assessed for postoperative nausea and vomiting. The search was widened to a 10-year time frame to find additional relative articles ranging from 2011-2021, resulting in 3 articles. One article outside of the search range was utilized due to the significance of the article. After applying the inclusion and exclusion criteria, widening the search to a 10-year time frame, and adding the article of significance, 15 articles were utilized. The literature review matrix is located in Appendix A.

The most widely known tool to predict the risk of PONV, the Apfel score, sets the foundation for this literature review. Apfel et al. (1999) designed an applicable model consisting of the four most important predictors of PONV, providing insight to who would benefit from prophylactic antiemetic therapy. Apfel et al. (1999) revealed that the incidence of PONV varies between 10-21% in patients with one or no risk factors, significantly increasing to 39-78% for patients with two risk factors. An increased risk of PONV implies a change or modification of the anesthetic technique, recommending prophylactic antiemetic therapy and/or the avoidance of volatile anesthetics by utilizing total intravenous anesthesia (TIVA) (Apfel et al., 1999).

Propofol's Effect on PONV

Evidence has shown that a combination of antiemetic medications has a significant impact on the reduction of PONV than a single antiemetic alone (Gan et al., 2020; Muhly et al., 2020; Weibel et al., 2020). The Fourth Consensus Guidelines for the Management of PONV

signify a reduction in PONV with the use of a subhypnotic propofol infusion when combined with an antiemetic for general anesthesia (Gan et al., 2020) with Muhly et al. (2020) recommending the combination of ondansetron, dexamethasone, and a subhypnotic dose of propofol. Due to the antiemetic effect of propofol, TIVA with propofol has been widely utilized for general anesthesia, especially when there are concerns for PONV. Several studies have revealed a reduction in the incidence of PONV when utilizing TIVA with propofol compared to volatile anesthesia (Elbakry et al., 2018; Pang et al., 2021; Park et al., 2020; Schraag et al., 2018). Schraag et al. (2018) discovered a 39% risk reduction in PONV with TIVA, a significant reduction compared to 18.9% from previous studies. Apfel et al. (1999) revealed specific surgeries that possess an increased risk for PONV, one of which is laparoscopic. TIVA with propofol shows promising results during laparoscopic surgery in reducing PONV (Elbakry et al., 2017; Park et al., 2020). No significant difference in PONV was noted in one study when comparing TIVA with propofol versus desflurane, contradicting the results from multiple other studies (Aftab et al., 2019).

Volatile Anesthetic's Effect on PONV

Guidelines for the management of PONV recommend avoiding the use of volatile anesthetics and nitrous oxide, although this recommendation is not always feasible (Gan et al., 2020). The benefit of using a volatile anesthetic is partially owed to its cardioprotective effects. Studies have revealed that there was not an increase in the incidence of PONV when a volatile anesthetic was used as an adjunct to propofol based TIVA (Chen et al., 2016; Lai et al., 2018; Uchinami et al., 2019). Sevoflurane is advantageous due to its cardioprotective effects, rapid uptake and elimination, inhibition of pulmonary irritant receptors, and smooth emergence, which justifies the importance of using it during anesthesia (Kawano et al., 2016; Lai et al., 2018;

Uchinami et al., 2019). Chen et al. (2016) discovered that patients had less changes in mean arterial pressure (MAP) and a smoother recovery from anesthesia when desflurane was used as an adjunct to propofol anesthesia. TIVA and volatile anesthesia are two common methods of anesthesia that have been extensively researched, but there are few studies on the combination of a volatile anesthetic with a subhypnotic propofol infusion. Volatile anesthetics and propofol each possess characteristics that may be beneficial if used as a combination instead of using each agent alone.

Combination of Propofol and Volatile Anesthetic

Volatile anesthetics and propofol are universally utilized for general anesthesia, both having their own benefits and side effects. PONV continues to be a common side effect of volatile anesthetics, with propofol possessing antiemetic properties. There are few studies on the effects of a subhypnotic propofol infusion in conjunction with a volatile anesthetic to decrease PONV during anesthesia. From the studies published, the use of propofol in combination with a volatile anesthetic revealed a reduction in PONV (Kawano et al., 2016; Wolf et al., 2021; Won et al., 2011). Kawano et al. (2016) showed a 66% decrease in PONV when volatile anesthesia was combined with propofol for laparoscopic gynecological surgeries. Other studies that have shown a decrease in PONV with propofol combined with a volatile anesthetic by comparing the use of propofol alone versus propofol with a volatile anesthetic (Chen et al., 2016; Lai et al., 2018; Uchinami et al., 2019). One study focused on comparing propofol target-controlled infusion (TCI) and propofol TCI with the addition of low-concentration desflurane during the maintenance phase of anesthesia for laparoscopic cholecystectomy surgery. The study revealed a low incidence of PONV in both groups with 96.2% of the propofol TCI group and 95.8% of the propofol TCI with desflurane group experiencing no PONV, most likely due to the antiemetic

effects of propofol (Chen et al., 2016). Uchinami et al. (2019) conducted a study comparing the incidence of PONV in patients that received propofol alone with patients that received propofol in conjunction with 0.8% sevoflurane. The results of the study revealed that the combination of propofol with a sevoflurane did not increase the incidence of PONV when compared to propofol alone, once again highlighting the importance of the antiemetic effect of propofol when combined with a volatile anesthetic (Uchinami et al., 2019). Overall, the incidence of postoperative nausea and vomiting was decreased when propofol was utilized in conjunction with a volatile anesthetic (Chen et al., 2016; Kawano et al., 2016; Uchinami et al., 2019; Wolf et al., 2021; Won et al., 2011).

Theoretical Framework

The theoretical framework utilized for this scholarly project is the Theory of Symptom Management. The Theory of Symptom Management, a middle range theory, comprises of three major concepts: symptom experience, symptom management strategies, and outcomes (Smith & Liehr, 2018). Applying the concepts of the Theory of Symptom Management to decrease the incidence of PONV, multimodal prophylaxis should be utilized for patients with PONV risk factors. Nausea and vomiting, especially in the postoperative period, are two of the most common side effects after anesthesia producing noteworthy patient dissatisfaction (Gan et al., 2020). A subjective experience, such as nausea and vomiting, would be described as a symptom, which can lead to disruptions in physical, mental, and social functioning (Smith & Liehr, 2018).

The concept of symptom experience signifies perception and response to a change, whether that change be in frequency or severity (Smith & Liehr, 2018). PONV occur more frequently in females, nonsmokers, those with a history of motion sickness or PONV, and patients who receive postoperative opioids (Apfel et al., 1999). The increasing incidence and

severity of nausea and vomiting in the postoperative period can lead to a distressing situation for the patient, interfere with their care, and delay their recovery. Strategies for the concept of symptom management include efforts to minimize the symptom experience by reducing the incidence and severity of the symptom and alleviating the associated distress (Smith & Liehr, 2018).

The framework specifies the intervention by asking who, what, when, where, how, and why. The "what" indicates the strategy and could include a combination of interventions, such as the multimodal approaches utilized for decreasing the incidence of PONV. The "how" and "when" specify the dose and timing of the intervention strategy. The fourth consensus guidelines for the management of postoperative nausea and vomiting recommend the combination of ondansetron and dexamethasone, with 4-8mg of dexamethasone at induction and 4mg of ondansetron at the end of surgery (Gan et al., 2020). Lastly, the concept of symptom outcomes refers to measurable outcomes to assess before and after implementation of the proposed intervention (Smith & Liehr, 2018). The goal of symptom outcome is to improve the patient's symptom, leading to a shorter hospital stay, decreased healthcare cost, better physical and mental functioning, and an overall improved quality of life (Smith & Liehr, 2018).

Goals, Objectives, and Expected Outcomes

This DNP project was designed to determine whether the addition of a continuous subhypnotic propofol infusion in conjunction with a volatile anesthetic decreases the incidence of PONV. The goals of this project were to 1) identify the incidence of PONV in high-risk patients, including those of female gender, nonsmokers, patients undergoing gynecological and laparoscopic surgeries, and the use of a volatile anesthetic; 2) identify the differences in the need for antiemetic medication in the PACU between patients who received a subhypnotic propofol

infusion in conjunction with a volatile anesthetic and those who only received a volatile anesthetic; 3) evaluate if a subhypnotic propofol infusion in conjunction with a volatile anesthetic decreases the incidence of PONV. The expected outcomes of this project were to improve guidelines on the prevention of PONV, ultimately improving patient care.

Project Design and Methods

This project utilizes a quality improvement design by the evaluation of a practice intervention to improve the guidelines on preventing PONV after anesthesia. High-risk patients who received a continuous subhypnotic propofol infusion at 0.1-0.5 mg/kg/hr with a volatile anesthetic will be compared to patients who only received a volatile anesthetic. Incidence of PONV will be documented and recorded in the patient's electronic medical record (EMR). Utilizing the EMR, a qualitative and quantitative evaluation will be made regarding the incidence of PONV and the dose of antiemetic given.

Project Site and Population

This DNP project was implemented at a 199 bed, Level III trauma center, private hospital in the Midwest United States. The full-service hospital offers a wide array of surgical procedures including general, orthopedic, neuroskeletal, gynecological, gastrointestinal, urology, plastics, healthy pediatrics, vascular, laparoscopic, and robotic surgeries. The facility employs full-time anesthesiologists and four certified registered nurse anesthetists under a medical supervision model with a physician-led team approach.

The population being evaluated in this study were high-risk PONV patients undergoing general anesthesia. The inclusion criteria consisted of the female gender, age 20-50 years old, nonsmokers, gynecological and laparoscopic surgeries, patients that received ondansetron and dexamethasone (antiemetics) intraoperatively, the use of volatile anesthetics, and patients that

received a continuous subhypnotic propofol infusion at 0.1-0.5 mg/kg/hr and patients that did not receive a continuous subhypnotic propofol infusion. The exclusion criteria consisted of the male gender, age less than 20 or greater than 50 years old, current smokers, surgeries that are not gynecological or laparoscopic, patients that did not receive ondansetron and dexamethasone intraoperatively, and not using volatile anesthetics. The experimental group consisted of the patients that received a continuous subhypnotic propofol infusion and the control group consisted of patients that did not receive a continuous subhypnotic propofol infusion.

A retrospective analysis of data was utilized for this study in the form of chart review. A total of 60 patient EMRs were utilized that met the criteria, 30 in the experimental group and 30 in the control group. Once all of the data was collected, a statistical analysis of the data was conducted to determine if there was a significant difference in the incidence of PONV between the two groups.

Measurement Instruments

In order to measure the outcomes of this DNP project, a project lead created tool was utilized. The measurement instrument consisted of a spreadsheet that was developed in Microsoft Excel. The project lead created tool is located in Appendix B. All of the variables were categorical, except for the antiemetic dose that was given in the postanesthesia care unit (PACU) for PONV. The variables utilized in the Microsoft Excel spreadsheet consist of age, categorized as 1 for 20-30 years old, 2 for 30-40 years old, and 3 for 40-50 years old; type of surgery, 1 for laparoscopic, 2 for gynecological, and 3 for a combination of laparoscopic/gynecological; volatile anesthetic, 1 for sevoflurane and 2 for desflurane; propofol infusion, 1 for yes if the patient received a continuous subhypnotic propofol infusion and 2 for no if the patient did not receive a continuous subhypnotic propofol infusion; and PONV, 1 for yes if the patient

experienced PONV in the PACU and received antiemetics and 2 for no if the patient did not experience PONV in the PACU and did not receive antiemetics.

Data Collection Procedures

A retrospective chart review was conducted at a private hospital in the Midwest to determine whether the addition of a continuous subhypnotic propofol infusion in conjunction with a volatile anesthetic decreases the incidence of PONV. 60 patient EMRs from August 2021 to December 2021 were utilized that met the criteria. The inclusion criteria for the experimental group consisted of the female gender, 20-50 years of age, nonsmokers, laparoscopic and gynecological surgeries, patients that received ondansetron and dexamethasone intraoperatively, the use of volatile anesthetics, and the use of a continuous subhypnotic propofol infusion at 0.1-0.5 mg/kg/hr. The inclusion criteria for the control group consisted of all of the variables in the experimental group except they did not receive a continuous subhypnotic propofol infusion. Evaluation of the experimental and control group occurred to determine whether the patients experienced PONV and needed antiemetics in the PACU. The results of the retrospective study concluded whether the addition of a continuous subhypnotic propofol infusion in conjunction with a volatile anesthetic decreased the incidence of PONV.

Ethical Consideration/Protection of Human Subjects

The Marian Internal Review Board (IRB) approval was obtained prior to initiating this DNP project. The project did not involve an intervention or interaction with living subjects. The data collected for this project was used to support a hypothesis. The data was de-identified, and patients remained anonymous. To ensure protection of human rights and HIPPA, the variables of each category that could potentially impact HIPPA were generalized to maintain confidentiality. A random ID number was assigned to each patient, age ranges were used instead of specific

ages, and a type of surgery instead of specific surgeries. All electronic files containing identifiable information were password protected to prevent access by unauthorized users. Informed consent was not needed due to the retrospective nature of the project. Refer to Appendix C for IRB approval.

Analysis

The data was analyzed using a Chi-Square Test of Independence. A Chi-Square Test of Independence was utilized to determine statistical significance between the control and experimental group results. All categorical data was evaluated in a frequency table. Frequencies and percentages were calculated for patient demographics that were categorical variables. Microsoft Excel was used to perform all statistical analyses.

Results

Participants

A total of 60 patient EMRs met the criteria for this project and were utilized in this study. Half of the patients met the inclusion criteria for the control group, whereas the other half met the inclusion criteria for the experimental group. Those in the experimental group all received a subhypnotic propofol infusion at 0.1-0.5 mg/kg/hr. Most patients (36.7%) were between the ages of 30 and 40, had undergone a laparoscopic/gynecological surgery (41.7%), and received sevoflurane as the volatile anesthetic (71.7%). Refer to Table 1 to view the demographics of all patients.

Table 1

Demographics and Characteristics of All Patients

Characteristics	n	%
Age Group		

20-30 years	20	33.3
30-40 years	22	36.7
40-50 years	18	30.0
Type of Surgery		
Laparoscopic	19	31.7
Gynecological	16	26.7
Combined Laparoscopic and Gynecological	25	41.7
Volatile Anesthetic		
Sevoflurane	43	71.7
Desflurane	17	28.3

Note. n=60

PONV

To determine whether the addition of a continuous subhypnotic propofol infusion in conjunction with a volatile anesthetic decreased the incidence of PONV, the patients that met the criteria for the experimental group were compared to those in the control group. There was not a statistically significant difference in the incidence of PONV between those who received a continuous subhypnotic propofol infusion in conjunction with a volatile anesthetic and those who did not. A Chi-Square Test of Independence resulted in a P value of 0.640428787, indicating a lack of statistical significance between the two groups in this study.

Discussion

This DNP project was designed to determine whether the addition of a continuous subhypnotic propofol infusion in conjunction with a volatile anesthetic decreased the incidence of PONV. This study consisted of an experimental group that received a subhypnotic propofol infusion at 0.1-0.5 mg/kg/hr in addition to a volatile anesthetic and a control group that only received a volatile anesthetic. The results of this study concluded that there was not a statistical

difference in the two groups, signifying that the addition of a subhypnotic propofol infusion in combination with a volatile anesthetic has no impact on PONV.

The results of this study did not correlate with a previous study by Kawano et al. (2016) that showed that the use of combined propofol and volatile anesthesia reduced the incidence of PONV. Kawano et al. (2016) did not follow the recommended multimodal approach to prevent PONV, therefore the high-risk patients in the study did not receive any prophylactic antiemetics. All of the patients in this study had received a multimodal approach to prevent PONV by receiving ondansetron and dexamethasone intraoperatively. The use of the multimodal approach could have had an effect on the results of this study. It could be useful to reconduct the study and focus on patients who received a subhypnotic propofol infusion in conjunction with a volatile anesthetic that did not receive prophylactic antiemetics.

It has already been shown in studies the benefit of utilizing TIVA in patients that are high-risk for PONV. Volatile anesthetics and propofol both possess beneficial properties that make them favorable during anesthesia, verifying the importance of determining whether a subhypnotic propofol infusion decreases PONV in patients also receiving a volatile anesthetic. A study by Uchinami et al. (2019) showed the coadministration of sevoflurane and propofol did not increase PONV compared to TIVA. There are a limited number of studies available that show the significance of a reduction in PONV when propofol is used in conjunction with a volatile anesthetic, implicating the need for this study. Although the results of this study showed no statistical difference between the two groups, studies have been conducted that prove otherwise (Kawano et al., 2016; Uchinami et al., 2019).

There were several limitations to this project. The first limitation was the retrospective nature of this project and the accuracy of the data retrieved from the patient's EMRs. The quality

of the data collected is dependent on the familiarity of the user and therefore under-reporting or inaccurate documentation of nausea and/or vomiting presents a limitation. The study was subject to confounding as only specific factors were measured. The aim was to conduct research on high-risk PONV patients including women, nonsmokers, patients undergoing gynecological and laparoscopic surgeries, and the use of a volatile anesthetic; therefore, it is unclear whether the results from this study can be applied to other patient populations. The small sample size was an additional limitation. A prospective study is needed to extract significant data to determine whether the addition of a continuous subhypnotic propofol infusion in conjunction with a volatile anesthetic decreases the incidence of PONV.

Conclusion

In conclusion, the results of this study suggest that the addition of a continuous subhypnotic propofol infusion in conjunction with a volatile anesthetic presents no added benefit in decreasing the incidence of PONV in the PACU. Further studies are needed to show the effectiveness of a subhypnotic propofol infusion in conjunction with a volatile anesthetic to decrease the incidence of PONV in high-risk patients.

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Appendix A

Literature Review Matrix

Citation	Research Design & Level of Evidence	Population / Sample size n=x	Major Variables	Instruments / Data collection	Results
1. Aftab et al., 2019	Randomized Controlled Trial, Prospective Level I	n=183	TIVA with propofol Desflurane PONV Pain Awakening time Peritoneal stretch	Clavien-Dindo Classification Stata/SE 15.1	No significant difference was found between TIVA with propofol versus desflurane on PONV
2. Apfel et al., 1999	Prospective Level II	n=2,722	PONV Gender Smoking status Motion sickness Duration of operation Opioids Type of surgery	Logistic Regression Model	The risk factors can predict the incidence of PONV with at least two risk factors urging prophylactic antiemetic therapy
3. Chen et al., 2016	Randomized Controlled Trial, Prospective Level I	n=52	Propofol Desflurane Laparoscopic cholecystectomy	Pearson x2 test Student *t* test	Patients were more hemodynamically stable when a combination of propofol and desflurane was used for anesthesia versus propofol alone
4. Elbakry et al., 2018	Randomized Controlled Trial, Prospective Level I	n=100	TIVA with propofol Inhalation anesthesia Morbidly obese	GraphPad CONSORT flow diaphragm SPSS	TIVA showed superiority over inhalation anesthesia and provided better postoperative recovery with less side effects and analgesic requirements
5. Gan et al., 2020	Expert Opinions Level V	n=9,000	PONV risk factors Antiemetics Dosing and timing	None	To reduce the risk of PONV, the guidelines recommend the use of propofol infusions and avoidance of volatile anesthetics

6. Kawano et al., 2016	Randomized Controlled Trial, Prospective Level I	n=42	Sevoflurane Propofol PONV Antiemetic use Postoperative pain	SPSS Bonferroni post hoc tests	The incidence of PONV was decreased when propofol was combined with sevoflurane
7. Lai et al., 2018	Randomized Controlled Trial, Prospective Level I	n=90	Sevoflurane Propofol-based TIVA Cough reflex PONV	Schneider's Kinetic Model Mann-Whitney test Kruskal-Wallis test Chi-Square	The incidence of PONV was not increased with sevoflurane when combined with TIVA
8. Muhly et al., 2020	Quality Improvement Project Level V	n=817	Antiemetics (dexamethasone, ondansetron, and a low dose propofol infusion) PONV ACL reconstructions	IHI Model of Improvement PDSA Cycles QlikView	Patients experience lower emesis after surgery due to implementing standard PONV guidelines and reducing opioids
9. Pang et al., 2021	Systematic Review of RCTs and Meta-Analysis Level I	n=2,201	TIVA with propofol Inhalation anesthesia Rescue analgesia PONV IL-6 Survival rate	Stata 12.0 Egger's test Plot-digitizer software	TIVA showed a decrease in PONV and an increase in postoperative rescue analgesia compared to inhalation anesthesia
10. Park et al., 2020	Randomized Controlled Trial, Prospective Level I	n=80	TIVA with propofol Inhalation desflurane Recovery outcomes	Korean version of the Quality of Recovery-40 questionnaire	TIVA improves the quality of recovery postoperatively compared to desflurane
11. Schraag et al., 2018	Systematic Review of RCTs and Meta-Analysis Level I	n=20,991	PONV Propofol Inhalational agents Post-operative pain Emergence agitation Time to recovery Hospital length of stay Post-anesthetic shivering Hemodynamic instability	Cochrane Collaboration Tool	There was a reduction in PONV when using TIVA instead of volatile anesthetics, with a 39% risk reduction

12. Uchinami et al., 2019	Randomized Controlled Trail, Prospective Level I	n=77	Propofol 0.8% Sevoflurane and propofol PONV	Mann-Whitney *U* test Fisher exact test	PONV is not increased with sevoflurane with propofol compared to TIVA with propofol
13. Wolf et al., 2021	Randomized Controlled Trial, Prospective Level I	n=1,960	PONV Time to extubation Pain Movement Propofol Volatile anesthetics	Model of Random Effects Comprehensive Meta-Analysis Version 3.0	The incidence of PONV was reduced with the combination of propofol and volatile anesthetics compared to only volatile anesthetic
14. Won et al. 2011	Randomized Controlled Trial, Prospective Level I	n=177	PONV Sevoflurane TIVA with propofol Antiemetics	SPSS Bonferroni post hoc test	The incidence of PONV was decreased with TIVA and combined anesthesia with propofol, sevoflurane, and remifentanil
15. Weibel et al., 2020	Randomized controlled trials (RCTs) Level I	n= 97,516	Antiemetic drugs (aprepitant, ramosetron, granisetron, dexamethasone, and ondansetron) PONV	None	The study found that combinations of antiemetics were more effective in preventing vomiting, with NK1 receptor antagonists the most effective.

Appendix B

Project Lead Created Tool

	A	B	C	D	E	F	G
1	Field Name	Field Size	Data Type	Data Format	Description	Codes	Example
2	ID	2	Numeric	NN	Unique number assigned to each patient		11
3	Age	1	Numeric	N	Age range of patient	1=20-30 yrs, 2=30-40 yrs, 3=40-50 yrs	2
4	Surgery	1	Numeric	N	Type of surgery	1=Laparoscopic, 2=Gynecological	1
5	Volatile_Anesthetic	1	Numeric	N	Volatile anesthetic the patient received	1=Sevoflurane, 2=Desflurane	1
6	Propofol_Infusion	1	Numeric	N	Has the patient received a continuous subhypnotic propofol infusion?	1=Yes, 2=No	2
7	PONV_Antiemetics_PACU	1	Numeric	N	Has the patient received antiemetics in the PACU for PONV?	1=Yes, 2=No	1
8	Antiemetic	1	Numeric	N	Type of antiemetic	1=Ondanestron, 2=Metoclopramide, 3=Prochlorperazine	1
9	Antiemetic_Dose	1	Numeric	N	Dose of antiemetic		4

Appendix C

IRB Approval

MARIAN UNIVERSITY
Indianapolis

Institutional Review Board

DATE:	3-24-2022
TO:	Kerri Ann Paris & Derrianne Monteiro
FROM:	Institutional Review Board
RE:	S22.116
TITLE:	A Retrospective Study on the Use of Intraoperative Subhypnotic Propofol Infusion in Conjunction with Volatile Anesthetics to Decrease PONV
SUBMISSION TYPE:	New Project
ACTION:	Determination of EXEMPT Status
DECISION DATE:	3-24-2022

The Institutional Review Board at Marian University has reviewed your protocol and has determined the procedures proposed are appropriate for exemption under the federal regulations. As such, there will be no further review of your protocol and you are cleared to proceed with your project. The protocol will remain on file with the Marian University IRB as a matter of record. Please be mindful of the importance of reporting only de-identified, HIPPA-compliant information about the patient in any exhibit or publication.

Although researchers for exempt studies are not required to complete online CITI training for research involving human subjects, the IRB **recommends** that they do so, particularly as a learning exercise in the case of student researchers. Information on CITI training can be found on the IRB's website: http://www.marian.edu/academics/institutional-review-board.

It is the responsibility of the PI (and, if applicable, the faculty supervisor) to inform the IRB if the procedures presented in this protocol are to be modified of if problems related to human research participants arise in connection with this project. Any procedural modifications must be evaluated by the IRB before being implemented, as some modifications may change the review status of this project. Please contact me if you are unsure whether your proposed modification requires review. Proposed modifications should be addressed in writing to the IRB. **Please reference the above IRB protocol number in any communication to the IRB regarding this project.**

Amanda C. Egan, Ph.D.